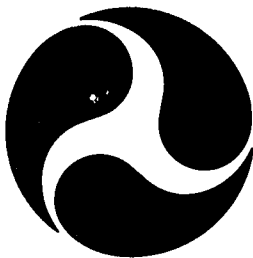


July 19, 1982



DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

SPECIFICATION

LOW NOISE AMPLIFIER ASSEMBLY

1. SCOPE

1.1 Scope.- This specification sets forth the requirements for a Low Noise Amplifier (LNA) Assembly. The LNA Assembly will be a replacement for the ASR-8 parametric amplifier and will be mechanically interchangeable with the parametric amplifier. It will require no modifications or changes to existing power sources, cabling or other interfacing components. Among other advantages, the LNA Assembly will provide improvements in reliability, RF gain, noise figure, and signal-to-noise ratio.

2. APPLICABLE DOCUMENTS

2.1 FAA Specifications.- The following specifications of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this standard and are applicable to the extent specified herein.

FAA-STD-013 Quality Control Program Requirements and Standards.

FAA-G-2100 Electronic Equipment, General Requirements

2.2 Military Specification.- The following military specifications of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

MIL-E-17555 Electronic and Electrical Equipment and Associated Repair Parts, Packaging and Packing Of.

MIL-STD-454 Standard General Requirements for Electronic Equipment

MIL-HDBK-217 Reliability stress and Failure Rate Data for
Electronic Equipment

Copies of FAA specifications may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or requests for proposals. Requests should fully identify material desired, i.e., specification standard, drawing numbers, and dates. Requests should cite the invitation for bids, requests for proposals or the contract involved or other use to be made of the requested material.

Requests for copies of Military specifications and standards should be addressed to Commanding Officer, Naval Supply Depot, 5811 Tabor Ave., Philadelphia, PA 19120.

3. REQUIREMENTS

3.1 Equipment to be furnished by the Contractor.- The contractor shall furnish any item or part necessary for proper operation in accordance with the requirements of this specification even though that item or part may not be specifically provided for or described herein. All parts, hardware, connectors, cables and adapters necessary to insure proper operation shall be furnished by the contractor. Each LNA assembly shall be complete and in accordance with all specification requirements and shall not require modification of any existing part of the ASR-8 system.

3.1.1 Equipment Description.- The LNA assembly specified herein shall accept received radar signals in the 2.7 to 2.9 GHz frequency range from the antenna RF switch of the ASR-8. Low noise amplification of the received signals shall be provided by the LNA prior to input to the receiver mixer.

3.1.2 Equipment Design.- The equipment specified herein shall essentially consist of a LNA module, an input isolator and a mounting bracket. The LNA and isolator combination shall include input and output RF connectors which connect to the ASR-8 RF switch and preselector filter respectively. An appropriate receptacle shall also be furnished to supply power and other status signals to/from the amplifier module. All connectors and receptacles shall mate with corresponding cable connectors on the ASR-8. An on-off switch shall be provided to remove power from the module and to control receiver status indications.

The mounting bracket shall support the LNA assembly and isolator and be attachable to the wall of the ASR-8 receiver cabinet using existing parametric amplifier mounting holes.

The amplifier module and isolator shall be attached to the mounting bracket in a manner to allow quick removal and replacement of either item in the event of failure. This shall not require removal of the mounting bracket.

3.1.3 Operating Conditions.- Characteristics of the ASR-8, of which the LNA assembly will become a part are as follows:

- | | |
|---------------------|-----------------|
| (a) Type Receiver | Superheterodyne |
| (b) Frequency Range | 2.7 to 2.9 GHz |

(c) System Noise Figure (Measured at antenna side of circulator)	4.0dB
(d) Receiver Intermediate Frequency	30 MHZ
(e) Minimum Discernible Signal (MDS)	
Normal Receiver	-110dBm
MTI Receiver	-108 dBm
Normal Log Receiver	Not more than 1 dB below linear MTI receiver
MTI Log Receiver	Not more than 1 dB below linear MTI receiver

3.1.4 Input Signal.- The LNA must be able to withstand + 20 dBm of CW power and + 30 dBm of .6 microsecond peak pulse power without damage.

3.1.5 Input/Output Impedance.- The LNA assembly shall have an input and output impedance of 50 ohms.

3.1.6 Power Source.- The equipment specified herein shall operate on regulated +15 and -15 Volts +10% DC supplied from the ASR-8 radar system. Current drain limits: + 15 volts; 7.5 amp, -15 volts; 5 amps.

3.1.7 Service Conditions.- The equipment specified shall be designed to operate over the range of service specified for environment II (FAA-G-2100c, Paragraph 3.2.15)

3.2 Performance Characteristics.- The equipment specified herein shall meet the following performance requirements.

	<u>Min</u>	<u>Max</u>
(a) Operating Frequency	2.7 GHz	2.9 GHz
(b) Instantaneous Bandwidth	200 MHz	---
(c) Input Signal for 1 dB compression of output signal	-30 dBm	---
(d) Noise Figure	---	1.25dB
(e) RF Gain	18.0dB	---
(f) Ripple (Gain variation)	---	1.0dB

The LNA isolator combination shall provide a minimum of 35 dB active isolation from the antenna RF switch and the mixer.

3.3 MECHANICAL REQUIREMENTS

3.3.1 Materials.- The materials used for the manufacture of each part shall be as specified herein. When materials or class of materials are not specified, a material shall be used which will enable the device to meet the requirements of this specification. The materials, finishes and markings shall not blister, crack or be adversely affected when exposed to the storage, operating or environmental conditions of this specification.

3.3.2 Dimensions.- The overall dimensions of the LNA assembly, which includes LNA module, isolator and mounting hardware shall not exceed the existing space requirements of the ASR-8 parametric amplifier assembly. Overall dimensions of this assembly are 10 $\frac{1}{4}$ " wide X 9 $\frac{1}{4}$ " high X 10" deep. Figure 1 shows pertinent dimensions and cable locations on the parametric amplifier assembly. Figure 2 is a photograph showing the location of the parametric amplifier in the receiver cabinet. Mounting brackets for the LNA assembly shall be so designed as to allow use of the existing mounting holes in the receiver cabinet while occupying minimum space.

The dimensions shown on figure 1 are based on the best available information. The contractor is expected to visit an FAA ASR-8 facility to obtain precise dimensional data prior to beginning assembly design. Details concerning site locations and coordination required will be specified in the procurement document.

3.3.3 Cabling and Connectors.- The contractor shall furnish mating connectors to interface the LNA assembly with the ASR-8 RF switch, and preselector filter and to supply DC voltages and control signals to the LNA module.

In complying with this requirement the following connectors shall be furnished by the contractor as parts of the LNA Assembly:

- (a) Power/status connector, MS3122E14-19P, (MS 3126F-14-19S Mating).
- (b) RF switch connector, type N, female, 1 each (Type N Male, Mating).
- (c) Preselector filter connector, type N, female, 1 each. (Type N, Male Mating).

Existing ASR-8 coaxial and semi-rigid cable and connectors will be utilized in connecting the LNA module, isolator, and power/status connector into the receiver cabinet. Semi-rigid coaxial cable is installed between the RF switch and the parametric amplifier isolator in the ASR-8 receiver cabinet. The contractor shall design the LNA assembly in a manner to minimize movement of the semi-rigid cable from its present position.

3.3.4 Welding, brazing or soldering.- Welds, brazing, or soldering shall comply with the requirements of paragraphs 4, 13, and 24 of MIL-STD-454.

3.4 Reliability and Maintainability.- The equipment specified herein shall be designed for continuous and reliable operation. Reliability and maintainability requirements for the LNA module and isolator are as follows:

LNA Module:

- (a) Mean-time-between-failure (MTBF): 250,000 hours.
- (b) Mean-Time-To-Restore (MTTR): 10 Minutes maximum.

Isolator:

- (a) MTBF: 50,000 hours
- (b) MTTR: 10 minutes maximum

Equipment MTBF predictions shall be based on reliability stress and failure rates contained in MIL-HDBK-217. When parts are not included in the coverage of MIL-HDBK-217, existing available failure rate data or valid predictions shall be used to calculate reliability.

3.4.1 Failure Analysis.- The manufacturer shall perform a failure analysis on all parts that fail any of the tests required by Section 4 of the specification. The analysis shall incorporate state-of-the-art techniques. The FAA shall be advised of all failures within 24 hours of their occurrences. Failure reports containing the analysis and results shall be available to the Government at all times and a summation of all failures and their results shall be provided to the Government every 30 days.

3.5. Documentation.- The contractor shall supply reproducible copies of replacement pages for Vol. I, III, Appendix, and the Troubleshooting Manual for the ASR-8 Instruction Book, TI 6310.13A, which result from replacement of the ASR-8 parametric amplifier with the LNA assembly. Installation instructions shall include parametric amplifier removal. Test procedures shall include instructions for measuring or calculating parameters in paragraph 3.2 except 3.2(d), noise figure. Government furnished material (GFE) shall be provided as specified in the procurement document.

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- The contractor shall provide and maintain a quality control program which fulfills the requirements of Specification FAA-STD-013, Quality Control Program Requirements. The contractor's quality program shall be a scheduled and disciplined plan of events integrating all necessary inspections and test required to substantiate product quality during the following phases: design, development, purchasing, subcontracting, manufacture, fabrication, processes, assembly, acceptance, packaging and shipping. The contractor shall perform or have performed all inspections and test required to substantiate product quality during design, development, purchasing, subcontracting, manufacture, fabrication, processes, assembly, acceptance, packaging and shipping. The contractor shall perform or have performed all inspections and tests required to substantiate product configuration and conformance to drawings, specifications and tests otherwise required by the contract. At the option of the Government, an FAA representative will witness the contractor's testing and inspections as deemed necessary to assure compliance with contract requirements. If witnessing is waived, the contractor shall furnish certified test data establishing proof of compliance with specification requirements. A test data sheet shall be furnished with each LNA assembly delivered.

4.2 Contractor's preliminary tests.- As specified in FAA-G-2100C, the contractor shall conduct all tests which are necessary to show compliance with this specification prior to the time the Government is notified that the initial lot of production LNA assemblies is ready for inspection.

4.2.1 Preliminary test data.- The contractor shall formally submit to the Government Contracting Officer a certified copy of the test data covering all preliminary tests made under paragraph 4.2. This test data shall be submitted together with (or in advance of) notification of readiness for inspection (4.2.2)

4.2.2 Notification of Readiness for Inspection.- The contractor shall formally notify the Government when he has one or more production equipments completed which have met all specification requirements, and are ready for Government inspection and tests.

4.3 Visual Inspection.- Prior to submittal for Government inspection and test each LNA assembly to be delivered under the contract shall be visually inspected by the contractor to determine compliance with the requirements of this specification.

4.3.1 Equipment Serialization.- Each LNA assembly shall be individually and permanently serialized and identified with the manufacturers part member and/or model number.

4.4 Reliability Analysis.- The contractor shall perform an analysis of the proposed design for the equipment specified herein to determine compatibility with the required MTBF. A failure rate shall be assigned to each part in the equipment in accordance with the data presented in the latest revision to MIL-HDBK-217. Parts not included in the coverage of MIL-HDBK-217 shall be assumed to possess the failure rate of the most similar part in the coverage. Where this is unrealistic any valid existing data may be used upon approval of the Government. The analysis shall be submitted to the Government no later than 60 days after award of contract. The analysis shall include a comparison of the predicted MTBF for the equipment with the required MTBF. Where the predicted figure is less than the requirement, the contractor shall accomplish such changes in the design as necessary to raise the predicted MTBF to the required value.

4.4.1 Maintainability.- Maintainability of the equipment specified herein is based upon module replacement. The MTTR requirements stated in paragraph 3.4 shall apply to removal and replacement of the LNA module and/or the isolator. The LNA assembly shall require no preventive maintenance or adjustment.

4.5 Type Tests.- The following type tests shall be made while subjecting the equipment specified herein to the test procedure described under paragraphs 4.3.3, and 4.3.3.1 of FAA-G-2100c. Specific test procedures shall be submitted to the Government for approval 30 days prior to test.

	<u>TEST</u>	<u>PARAGRAPH</u>
(a)	Operating Frequency	3.2(a)
(b)	Instantaneous Bandwidth	3.2(b)
(c)	Input signal for 1dB compression of output signal	3.2(c)
(d)	RF Gain	3.2(e)
(e)	Noise Figure	3.2(d)
(f)	Ripple (Gain Variation)	3.2(f)

4.6 Production Tests.- The following production tests shall be performed on each deliverable LNA assembly under normal test conditions. The contractor shall submit a test plan and test data sheets for approval by the Government at least 30 days before the start of tests.

Tests

- (a) All tests listed in paragraph 4.5.

4.7 Field Demonstration Tests.- When specified by the contract schedule, the contractor shall perform field demonstration tests to verify that equipment meets specification requirements. The contractor shall submit a test plan for approval by the Government at least 30 days prior to the start of tests. As a minimum the following tests shall be performed.

	<u>TEST</u>	<u>Reference Paragraph</u>
(a)	Mechanical.	3.3.2 and 3.3.3
(b)	ON/OFF Operation.	3.1.2
(c)	Receiver status indication.	3.1.2
(d)	System noise figure.	3.1.3c
(e)	System minimum discernible signal (MDS)	3.1.3e

5. PREPARATION FOR DELIVERY

5.1 General Packing Requirements.- See MIL-D-17555. The level of packing and packaging shall be as specified in the procurement document.

6. NOTES

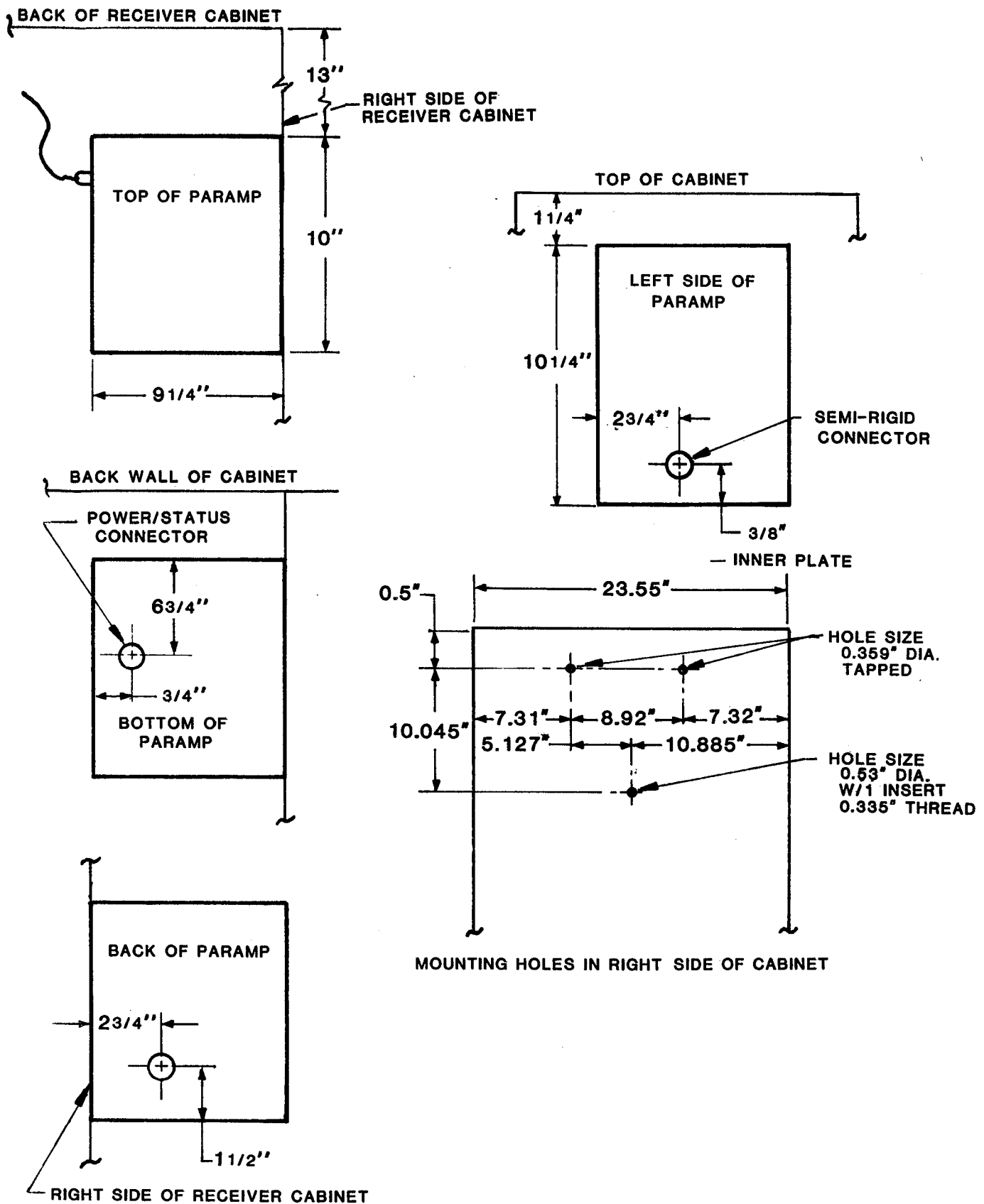


FIGURE 1. ASR-8 PARAMETRIC AMPLIFIER ASSEMBLY DIMENSIONS.

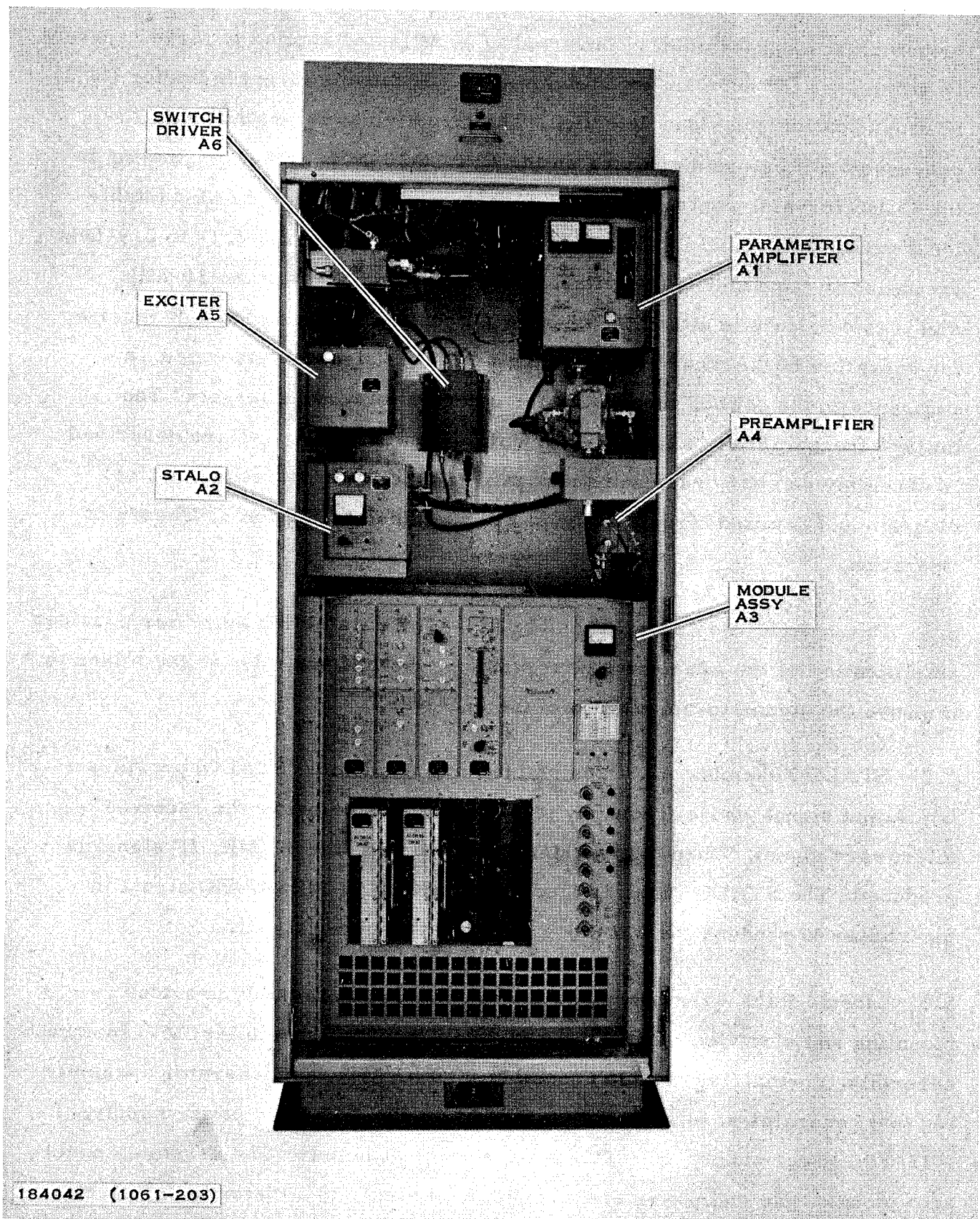


FIGURE 2. ASR-8 RECEIVER CABINET

